Факультет Программной Инженерии и Компьютерной Техники

Курсовая работа №1

Часть 2

По дискретной математике

Вариант 71

Выполнил:

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# Задание

Построить комбинационную схему реализующую функцию C=(A±1)mod15. При t = 0 сложение, при t = 1 вычитание. При переносе/заеме устанавливается бит е.

# Таблица истинности

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **№** | **t** | **а1** | **а2** | **а3** | **а4** | **e** | **с1** | **с2** | **с3** | **с4** |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 |
| 2 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 |
| 3 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 |
| 4 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| 5 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 0 |
| 6 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 |
| 7 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 |
| 8 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| 9 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 |
| 10 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 |
| 11 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 |
| 12 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 1 |
| 13 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 0 |
| 14 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| 15 | 0 | 1 | 1 | 1 | 1 | d | d | d | d | d |
| 16 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 |
| 17 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 18 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| 19 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 |
| 20 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| 21 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| 22 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 1 |
| 23 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 |
| 24 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| 25 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 |
| 26 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 |
| 27 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 |
| 28 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 1 |
| 29 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 |
| 30 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 1 |
| 31 | 1 | 1 | 1 | 1 | 1 | d | d | d | d | d |

# Минимизация булевых функций на картах Карно

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **E** |  | **a1, a2** | | | |
|  |  | 00 | 01 | 11 | 10 |
| **a3, a4** | 00 |  |  |  |  |
| 01 |  |  |  |  |
| 11 |  |  | d |  |
| 10 |  |  | 1 |  |
| t = 0 | | | | | |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | **a1, a2** | | | |
|  |  | 00 | 01 | 11 | 10 |
| **a3, a4** | 00 | 1 |  |  |  |
| 01 |  |  |  |  |
| 11 |  |  | d |  |
| 10 |  |  |  |  |
| t = 1 | | | | | |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **C1** |  | **a1, a2** | | | |
|  |  | 00 | 01 | 11 | 10 |
| **a3, a4** | 00 |  |  | 1 | 1 |
| 01 |  |  | 1 | 1 |
| 11 |  | 1 | d | 1 |
| 10 |  |  |  | 1 |
| t = 0 | | | | | |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | **a1, a2** | | | |
|  |  | 00 | 01 | 11 | 10 |
| **a3, a4** | 00 | 1 |  | 1 |  |
| 01 |  |  | 1 | 1 |
| 11 |  |  | d | 1 |
| 10 |  |  | 1 | 1 |
| t = 1 | | | | | |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  | **a1, a2** | | | |
|  |  |  | 00 | 01 | 11 | 10 |
| **a3, a4** |  | 00 | 1 |  |  |  |
|  | 01 |  |  |  |  |
|  | 11 |  |  | d |  |
|  | 10 |  |  |  |  |
|  | t = 1 | | | | | |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **C2** |  |  | **a1, a2** | | | |
|  |  |  | 00 | 01 | 11 | 10 |
| **a3, a4** |  | 00 |  | 1 | 1 |  |
|  | 01 |  | 1 | 1 |  |
|  | 11 | 1 |  | d | 1 |
|  | 10 |  | 1 |  |  |
|  | t = 0 | | | | | |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **C3** |  | **a1, a2** | | | |
|  |  | 00 | 01 | 11 | 10 |
| **a3, a4** | 00 |  |  |  |  |
| 01 | 1 | 1 | 1 | 1 |
| 11 |  |  | d |  |
| 10 | 1 | 1 |  | 1 |
| t = 0 | | | | | |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | **a1, a2** | | | |
|  |  | 00 | 01 | 11 | 10 |
| **a3, a4** | 00 | 1 | 1 | 1 | 1 |
| 01 |  |  |  |  |
| 11 | 1 | 1 | d | 1 |
| 10 |  |  |  |  |
| t = 1 | | | | | |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | **a1, a2** | | | |
|  |  | 00 | 01 | 11 | 10 |
| **a3, a4** | 00 |  | 1 | 1 | 1 |
| 01 |  |  |  |  |
| 11 |  |  | d |  |
| 10 | 1 | 1 | 1 | 1 |
| t = 1 | | | | | |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **C4** |  | **a1, a2** | | | |
|  |  | 00 | 01 | 11 | 10 |
| **a3, a4** | 00 | 1 | 1 | 1 | 1 |
| 01 |  |  |  |  |
| 11 |  |  | d |  |
| 10 | 1 | 1 |  | 1 |
| t = 0 | | | | | |

# Преобразование системы булевых функций

Sq = 92

# Синтез многовыходной комбинационной схемы в булевом базисе

Будем анализировать схему на следующем наборе аргументов: a1 = 0, a2 = 0, a3 = 0, a4 = 0

Выходы схемы из таблицы истинности: e = 0, c1 = 0, c2 = 0, c3 = 0, c4 = 1

Изображение выглядит как снимок экрана, черный, Симметрия, дизайн

Автоматически созданное описание

Te = 3τ; Tс1=4τ; Tс2=4τ; Tс3=3τ; Tс4=3τ

T = max (Тv, Tс1, Tс2, Tс3, Tс4) = 4τ

Цена схемы Sq = 92; Задержка схемы T = 4τ.